Student Reading

Wind Tunnels

Sometimes scientists create a **model** to help them explain how or why something works the way it does.

You may have seen model airplanes. These model airplanes are smaller than the real thing, and while the outside might look like the real thing, the inside does not. Many models are **scale models**. This means that every part of the airplane is made smaller by the same amount. Thus a scale model is an exact copy of the real thing - only smaller!

A scale model can be used to test a researcher's hypothesis in a safe and controlled way. In aeronautics, researchers and engineers use models to design and modify airplanes.

A model of an F-18 in the 80x120-foot test section.

Aeronautical researchers can make a scale model and mount it in a **wind tunnel**. A wind tunnel is a tube or tunnel through which air is blown. So, instead of an airplane flying through the air, a scale model of the airplane is mounted in a wind tunnel and air is blown around it.

Some wind tunnels are very large and can hold models that are the size of the real airplane. Some wind tunnels are very small and can only hold very tiny scale models of the airplane, or maybe a scale model of a part of the airplane. Some very small wind tunnels can only blow air only at very high speeds (over 3,000 miles per hour), while some of the largest tunnels blow air at less than 150 miles per hour. This may sound slow, but this is near takeoff and landing speeds for many airplanes. So, these big wind tunnels are very useful.

Over the years, NASA's Ames Research Center has operated over 20 wind tunnels of varying sizes and purposes. Today, however, three major tunnels are used at Ames to support civilian and military model tests:

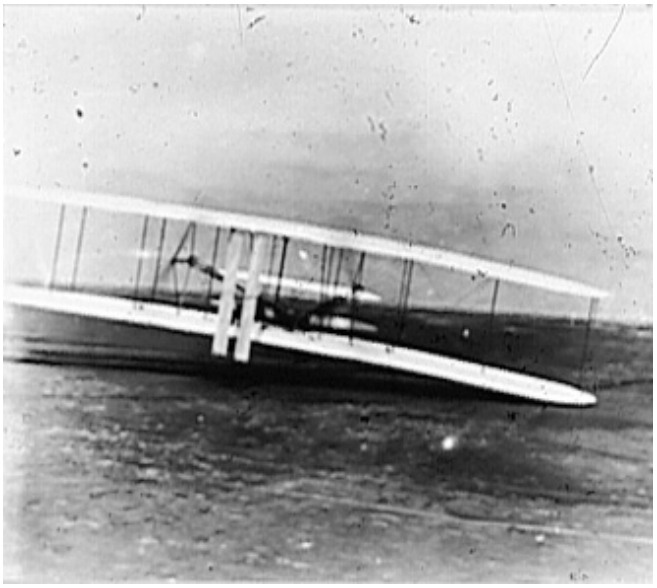
1. The National Full-Scale Aerodynamics Complex (NFAC) contains the 80x120-Foot Wind Tunnel and the 40x80-Foot Wind Tunnel. In wind tunnels, "80x120-Foot" and 40x80-Foot" indicates dimensions of the spaces in which the aircraft are tested. Both do large-scale or full-scale testing of aircraft and rotorcraft. The 80x120 tunnel will be used to test the Wright Flyer replica.

80x120 Wind Tunnel at NASA Ames Research Center.

2. The Unitary Plan Wind Tunnel has tested many models of commercial vehicles and fighter planes, as well as spacecraft from the Mercury, Gemini and Apollo programs and the Space Shuttle. The tunnel contains separate test sections for transonic and supersonic flight testing. In 1985, the facility was named a National Historic Landmark by the National Park Service because of "its significant associations with the development of the American Space Program."

3. The 12-Foot Pressure Wind Tunnel collects test data to support the development of high-lift systems for commercial transports and military aircraft and tests high angle-of-attack of maneuvering aircraft. Increasing the air pressure inside the tunnel makes the airflow around a small-scale model closer to the flow experienced on a full-size aircraft.

Engineers place instruments on the scale model and in the wind tunnel to take measurements while the wind is blowing. They measure the forces on the model and the pressures. All the measurements are collected and analyzed so that the researcher's hypothesis may be proved or disproved.



1903 Wright Flyer

In September 1992, the Los Angeles Section of the American Institute of Aeronautics and Astronautics (AIAA) approached the managers of the wind tunnels at NASA Ames to discuss a proposal for a test of their full-scale replica of the 1903 Wright Flyer. Although there have been some delays due to the schedules of other customers using the tunnel, as well as some recent construction in the tunnel, the Flyer is now on the 80x120-Foot Wind Tunnel calendar for 1999. The test will support two main goals: (1) it will provide aerodynamic data about the first successful, piloted airplane in history; and (2) the information will be used by AIAA to build a new, safe, near-replica to be flown at Kitty Hawk, North Carolina on December 17, 2003 in a centennial celebration of the birth of powered flight.